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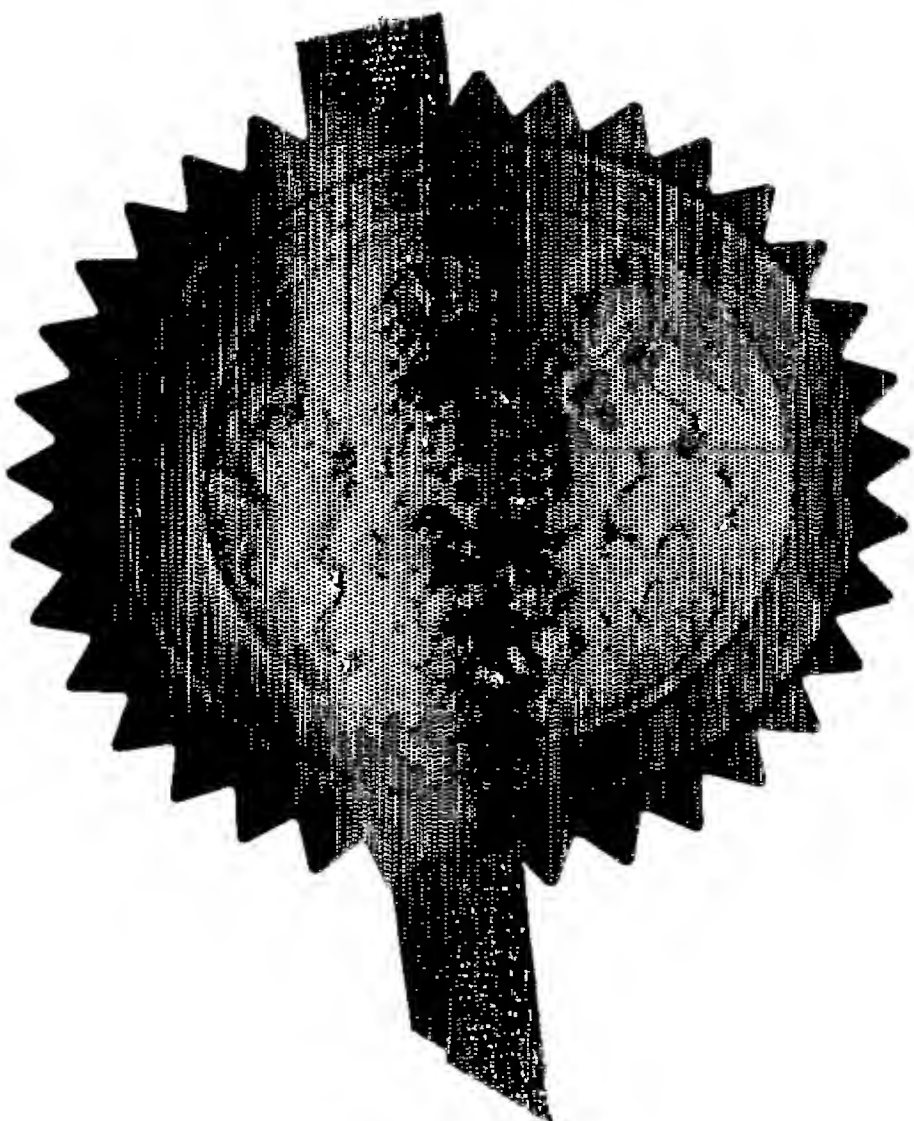
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GB 0406639.5

By virtue of a direction given under Section 30 of the Patents Act 1977, the application is proceeding in the name of:

E2V TECHNOLOGIES (UK) LIMITED,
106 Waterhouse Lane,
CHELMSFORD,
Essex,
CM1 2QU,
United Kingdom

Incorporated in the United Kingdom,

[ADP No. 08946873001].

Request for grant of a patent

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The Patent Office

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1. Your reference

JMV/46077.GB01

2. Patent application number
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0406639.5

24 MAR 2004

3. Full name, address and postcode of the or of each applicant (underline all surnames)

E2V Technologies Limited
106 Waterhouse Lane
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CM1 2QU

Patents ADP number (if you know it)

845 774900

If the applicant is a corporate body, give the country/state of incorporation

United Kingdom

4. Title of the invention

METHOD OF, AND APPARATUS FOR MANUFACTURING ELEMENTS

5. Full name, address and postcode in the United Kingdom to which all correspondence relating to this form and translation should be sent

Reddie & Grose
16 Theobalds Road
LONDON
WC1X 8PL

Patents ADP number (if you know it)

91001

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Country

Priority application
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Date of filing
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Number of earlier application

Date of filing
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- a) any applicant named in part 3 is not an inventor, or
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Continuation sheets of this form

Description

3

Claim(s)

1

Abstract

Drawing(s)

3+3

final

10. If you are also filing any of the following, state how many against each item.

Priority documents

Translations of priority documents

Statement of inventorship and right to grant of a patent (Patents Form 7/77)

Request for preliminary examination and search (Patents Form 9/77)

1

Request for substantive examination (Patents Form 10/77)

Any other documents (please specify)

11.

I/We request the grant of a patent on the basis of this application.

Signature

Date

24 March 2004

J M Vleck

12. Name and daytime telephone number of person to contact in the United Kingdom

J M VLECK
020-7242 0901

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Method of, and Apparatus for manufacturing Elements

The present invention is concerned with a method of manufacturing small elements. The preferred embodiments of the invention are particularly suitable for the manufacture of small (chip scale) components or microcomponents. The
 5 typical chip-scale component size is in the range 0.2mm to a few mm with features of down to 0.01mm. The term microcomponent is typically used to describe components which are not visible without the use of an optical microscope (e.g., typically within size range of 10^{-4} and 10^{-7} metres). Micro-components may be used in micro-structural devices.

10 Electronic microcomponents are typically made as arrays of components on a silicon substrate. It is more efficient to make a number of elements on the same substrate. The processes for creating an array of elements are well known and include, for example, photolithography. The microcomponents are formed as an array of connected elements which are separated from each other before being
 15 used.

US 5,824,595 discusses a method in which an array of electronic elements are created on a silicon substrate, and the elements are separated from each other by etching of the substrate.

A problem with the etching process disclosed in US 5,824,595 is that separate
 20 elements end up loose having been etched from the carrier. Due to their small size, they are prone to clump together and are difficult to separate without damage. There is therefore a low yield. For example, the typical yield for the separation of cross-shaped gold bonding preforms of the type shown in figure 1 and used to provide an electrical connection from a semiconductor to other
 25 components is only about 20%. Another problem is that any traceability of individual elements is lost when the elements are separated.

The present invention provides method and apparatus as defined in claims 1, 4, 8 and 9.

Preferred embodiments of the present invention allow one to remove components
 30 or elements one at a time in a controlled and/or controllable manner. This means that it is possible to prevent the formation of a mass or conglomerate of mixed up components.

Traceability of individual elements is also improved as the array format is kept right up to the point where an individual part or element is used. This means that a user or a system can determine and/or monitor which particular element or component is taken from where and then where it is placed.

- 5 A preferred embodiment of the invention will now be described, by way of example only, with reference to the attached figures in which:

Figure 1 illustrates a plan view of a portion of an array of elements prior to the separation into discrete components;

- 10 Figure 2 illustrates a method for manufacturing the array of electronic elements of figure 1;

Figure 3 is a schematic plan view of an array of elements having a pick-up tool positioned over one of the array's elements; and

Figures 4a to 4d illustrate a separation method embodying the invention for separating an element from the array of figures 1 or 3 using the pick-up tool.

- 15 Figure 1 illustrates an array 1 of gold bonding preforms 2 of the type used to provide an electrical connection from a semiconductor die to other current components. Each preform 2 has a Maltese cross like shape with the ends of each cross being connected by a tab 3 to a framework 4 which holds the elements 3 in place until they are separated from the framework.

- 20 An array 1 of connected components 2 may be (see figure 1) made by deposition on a sacrificial substrate 5 (see figure 2). First a metal seed layer of, for example, gold is vacuum deposited on a sacrificial substrate of, for example, silicon. A pattern matching the desired shape of the inter-connected array of components (see figure 1) is defined in the seed layer by photolithography and/or
25 chemical etching. A conductive material such as gold is then deposited in the defined pattern in the seed layer by electroplating through a photoresist mask. This is a known process.

- In the known processes such as that described in US, 5,824,595 the individual elements in the array of elements are then separated by a chemical etching
30 processes. This results in a jumble of elements and the disadvantages discussed above.

In the embodiment of the invention illustrated in figure 3, the element 2' to be separated from the array 1 is positioned on an insulating area 7 underneath an electrically conductive pick-up tool 8. The pick-up tool 8 is brought into contact with and grips the selected element 2. An electrical current is then passed
5 through the pick-up tool 8 and element 2' to the element holder or framework by way of tabs 4 holding the element in the array. The current heats up the tabs 3 thereby causing them to melt and free the element 2'. The pick-up tool 8 then lifts the separated element 2' from the array 1. The pick-up tool 8 may then place the element 2' in an element store or directly on a structure or component of
10 which the element is to form a part.

The invention is concerned with the selective and controllable application of energy to selected tabs so as to allow the separation of a selected or selected elements from an array of inter-connected elements. In an alternative embodiment of the invention having non-conductive tabs, the tabs may be
15 removed, for example, by laser ablation.

Claims

1. A method of manufacturing a number of discrete elements, comprising the steps of manufacturing an array of said discrete elements wherein each element is attached to a supporting structure and/or at least one other element by a support tab, and selectively removing or breaking the tab or tabs supporting a particular element or particular elements.
2. A method according to claim 1 wherein the tab or tabs are electrically conductive and are removed or broken by passing a current therethrough.
3. A method according to any preceding claim wherein the tab or tabs are removed or broken by laser ablation.
4. Apparatus for separating a selected element or selected elements from an array of inter-connected elements including a first portion capable of removing or breaking the connection or connections between a selected element and its neighbouring element or elements, and a second portion capable of picking up or otherwise removing the selected element or elements.
5. Apparatus according to claim 4 wherein the second portion includes means for applying energy to the connection or connections.
6. Apparatus according to claim 5 including means for causing a current to flow through the connection or connections.
7. Apparatus according to claim 5 or claim 6 including means for laser ablation of the connection or connections.
8. Method substantially as hereinbefore described with reference to the attached figures.
9. Apparatus substantially as hereinbefore described with reference to the attached figures.

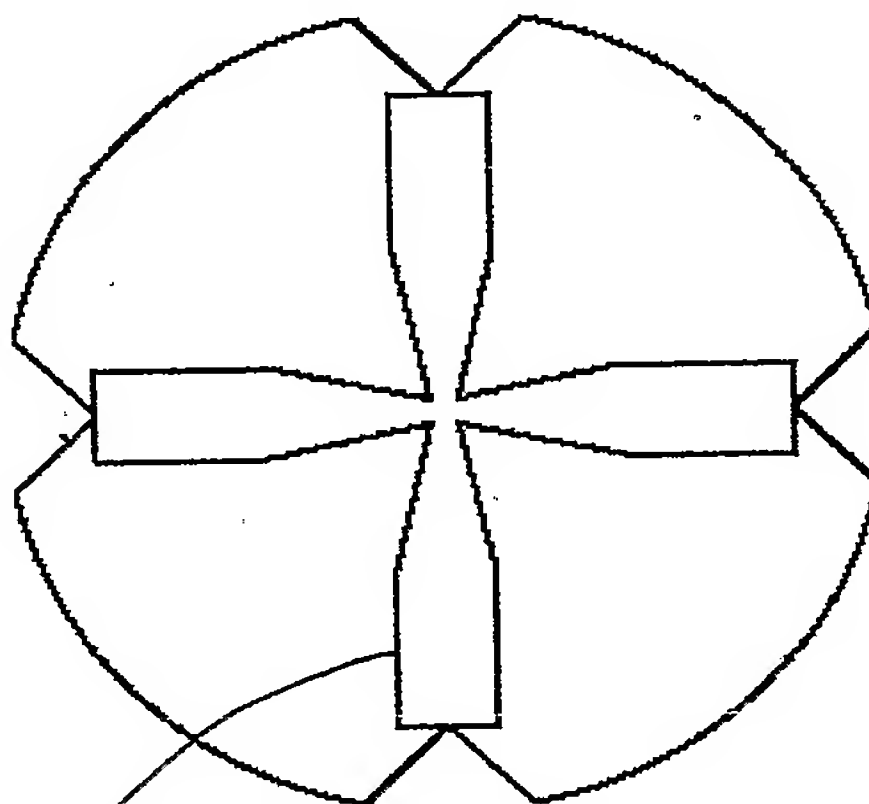
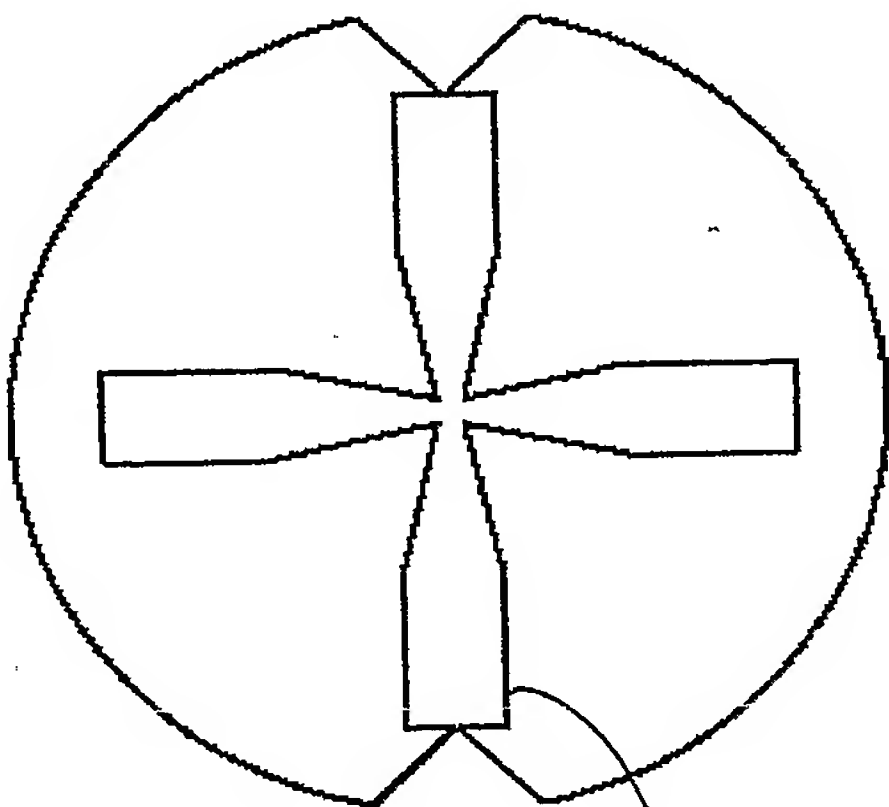
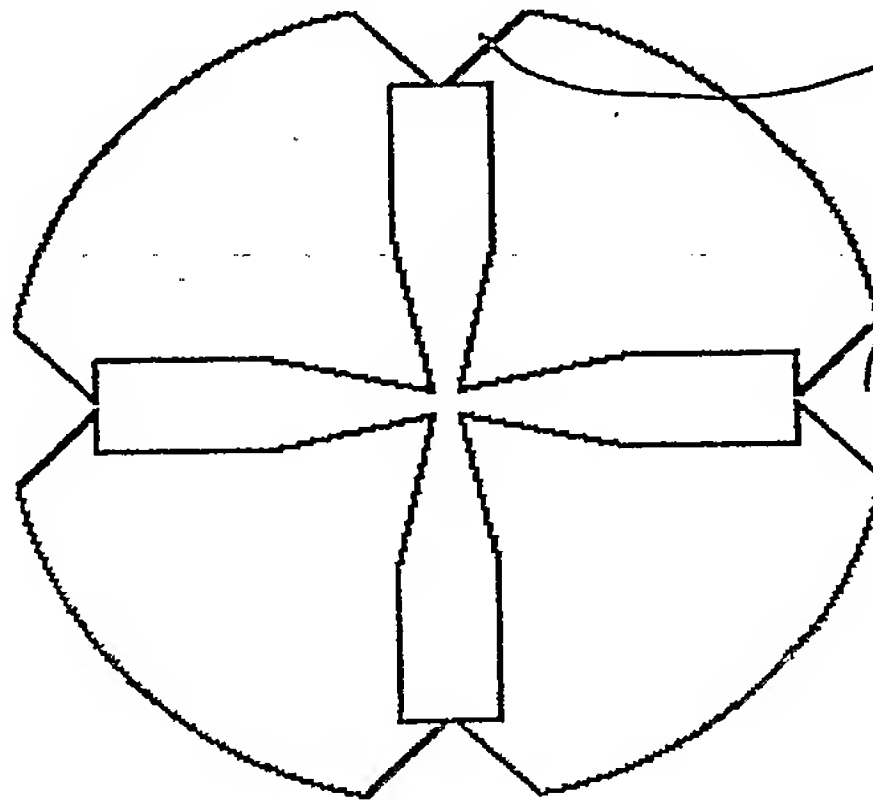
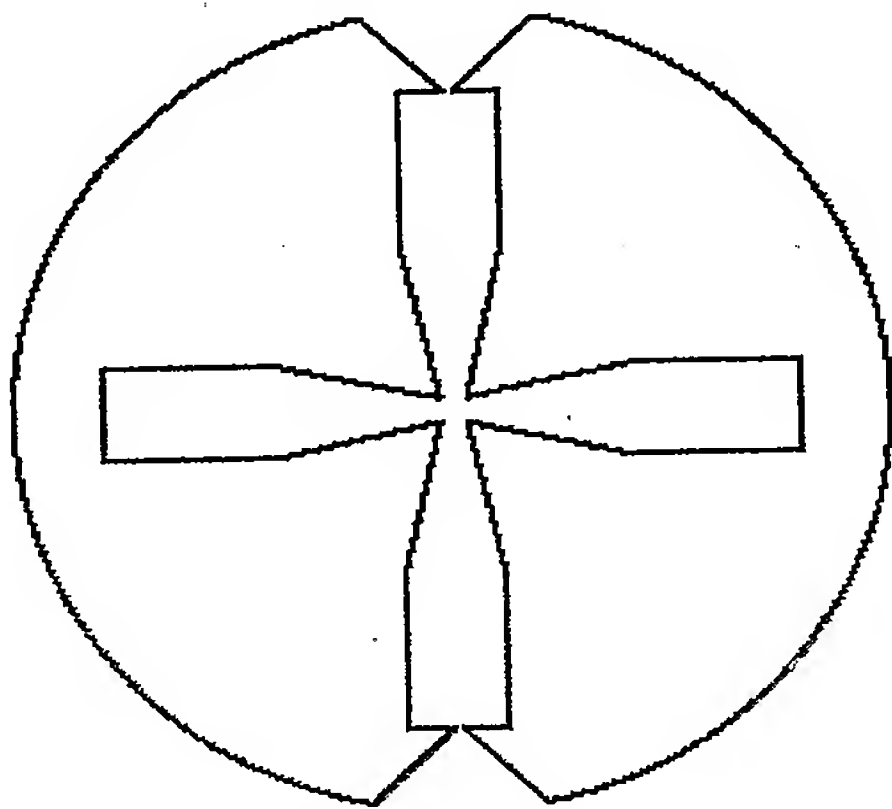


Figure 1

4

4

2

1

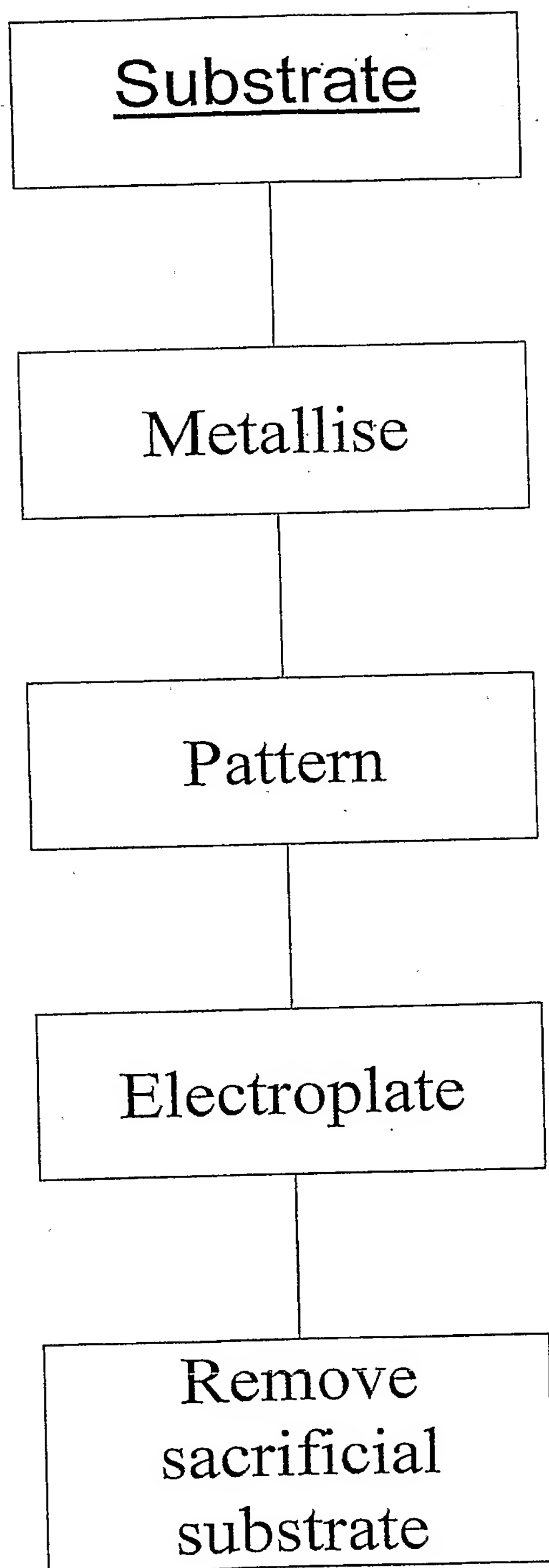


Figure 2

Figure 3

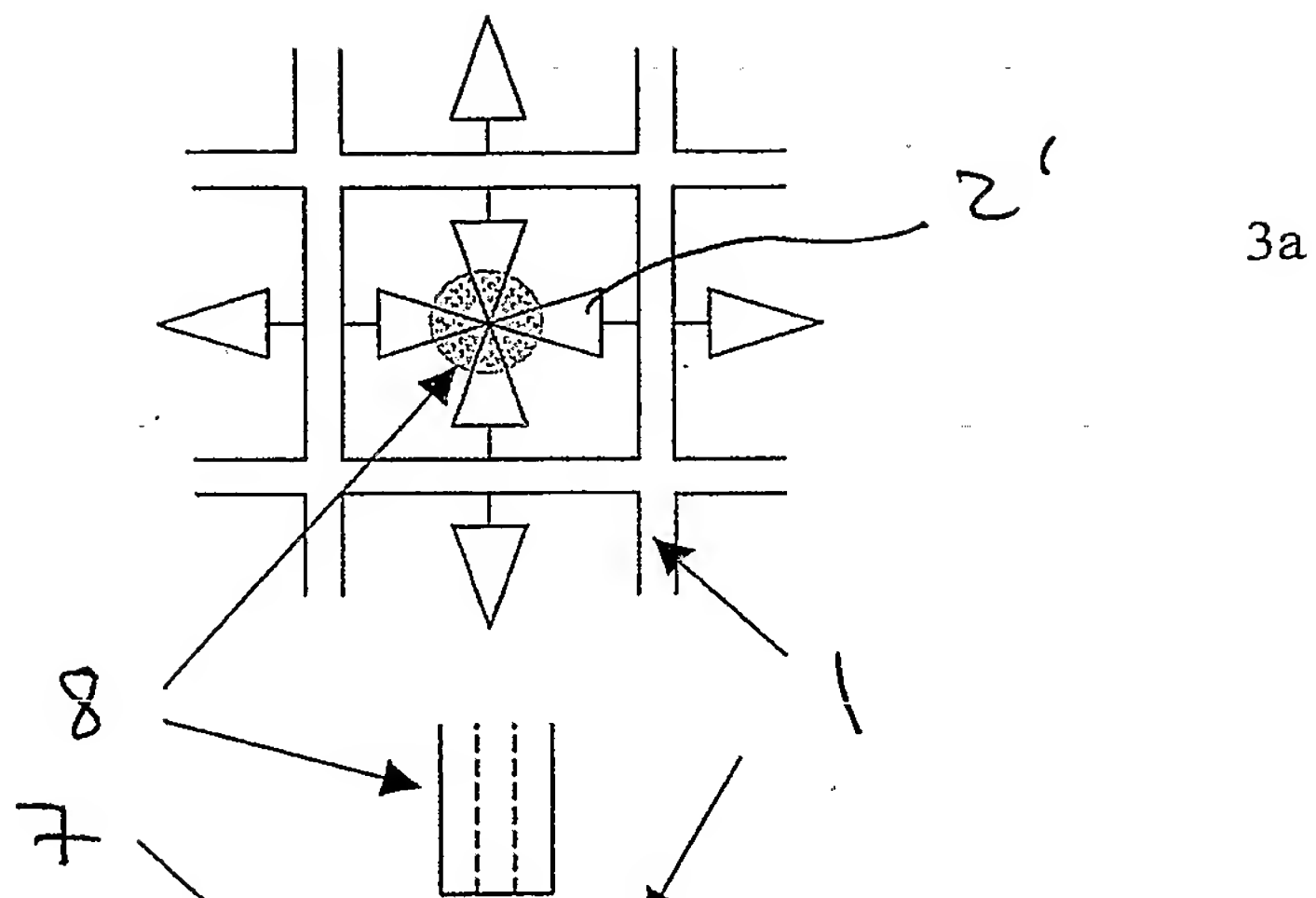


Fig. 4a)

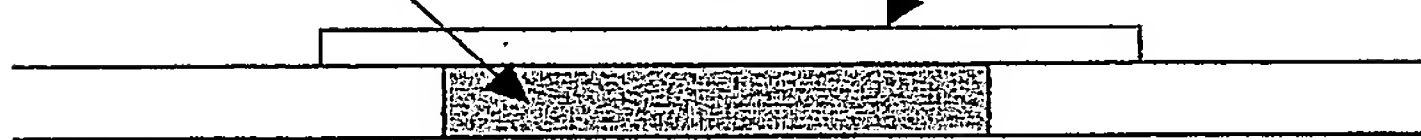


Fig. 4b)

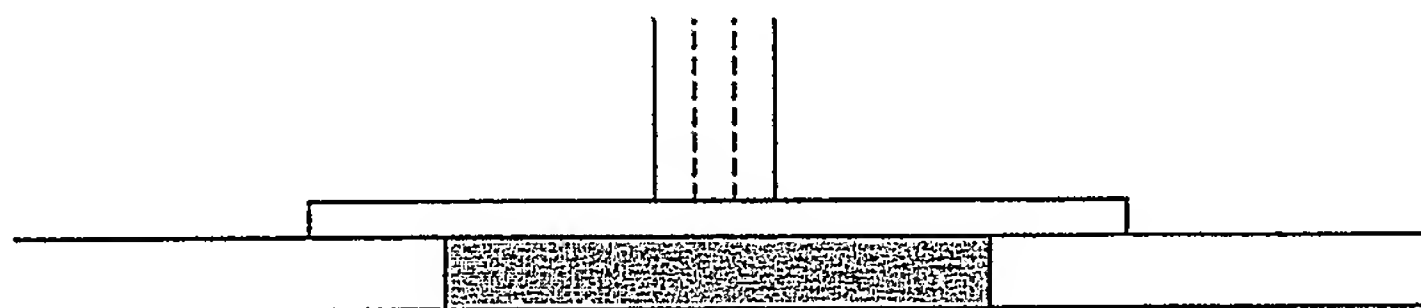


Fig. 4c)

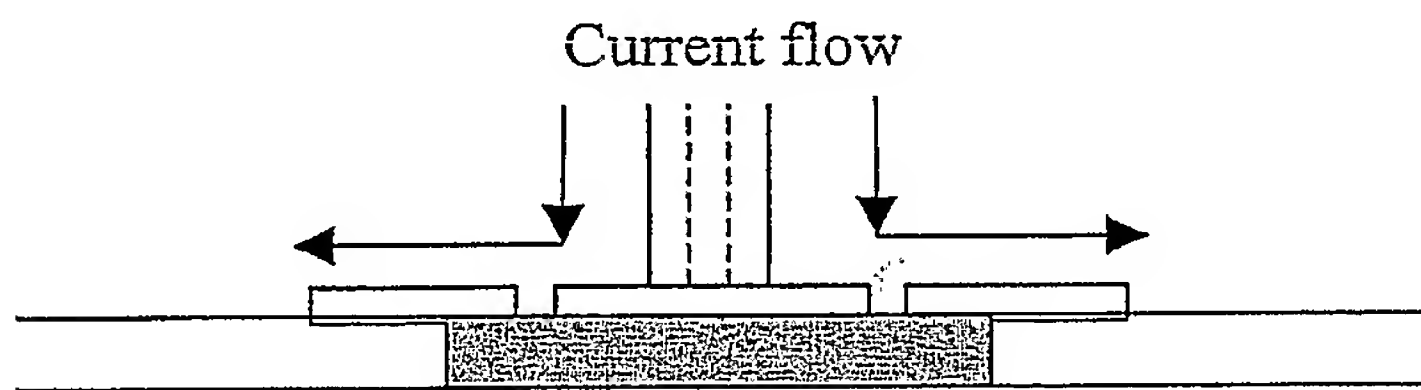


Fig. 4d)

